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இலங்கைப் பரீட்சைத் திணைக்களம்
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
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තොරතුරු හා සන්නිවේදන තාක්ෂණය I
தகவல், தொடர்பாடல் தொழினுட்பவியல் I
Information & Communication Technology I

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இரண்டு மணித்தியாலம்
Two hours

Instructions:

* *Answer* ***all*** *the questions.*
* *Write your* ***Index Number*** *in the space provided in the answer sheet.*
* *Instructions are also given on the back of the answer sheet. Follow those carefully.*
* *In each of the questions* **1** *to* **50**, *pick one of the alternatives from* (1), (2), (3), (4), (5) *which is* ***correct or most appropriate*** *and* ***mark your response on the answer sheet with a cross*** (×) ***in accordance with the instructions given on the back of the answer sheet.***
* *Use of calculators is* ***not allowed.***

1. Which of the following best represents the typical life cycle of data?
(1) collection → processing → usage → archival → deletion
(2) collection → usage → processing → deletion → archival
(3) processing → collection → usage → deletion → archival
(4) processing → archival → collection → usage → deletion
(5) usage → archival → collection → deletion → processing

2. Which of the following is a characteristic of *open-source software*?
(1) Limited customizations
(2) Reliance on vendor for updates
(3) Usage restricted by the owner
(4) Source code not being publicly available
(5) Being usually free to acquire and use

3. An online examination system is to alert students if they leave any mandatory questions unanswered before submission of their answers. Which data validation techniques are sufficient for this requirement?
(1) Data type check only
(2) Data type check and presence check only
(3) Data type check and range check only
(4) Presence check only
(5) Range check only

4. Which of the following best describes a pointing device?
(1) It is used to control an indicator on the display.
(2) It is used to digitize a scene.
(3) It is used to identify characters.
(4) It is used to read codes.
(5) It is used to select images.

5. Which of the following is a secondary storage device in which the data is written to in a sequential manner and can be read from in a random manner?
(1) CD-R
(2) CD-ROM
(3) Magnetic tape
(4) Solid State Drive
(5) USB flash drive

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6. Which of the following communication buses are involved in reading a data word from Main Memory?

A – Address Bus   B – Control Bus   C – Data Bus

(1) A only (2) B only (3) C only
(4) A and C only (5) All A, B and C

7. While an instruction is being executed in the Central Processing Unit, that instruction and the relevant data are stored in the

(1) address bus. (2) arithmetic and logic unit. (3) control unit.
(4) data bus. (5) registers.

8. If writing a 64-bit data word to a random-access memory takes 0.625 ns, how long will it take to read the same word back under the same conditions?

(1) 0.156 ns (2) 0.312 ns (3) 0.625 ns (4) 1.250 ns (5) 2.500 ns

9. Which of the following is true regarding EEPROM?

(1) It can store user data similar to the random access memory.
(2) Both of its writing and reading speeds are same.
(3) Information written on it can be erased.
(4) It requires electric power to retain information.
(5) The operating system is stored in it.

10. What is the correct hexadecimal equivalent of decimal 33.75_{10}?

(1) 11.6_{16} (2) 21.01_{16} (3) 21.11_{16} (4) 21.6_{16} (5) $21.C_{16}$

11. If a document with 1024 characters is converted from EBCDIC to ASCII with parity bit, how much space would be saved?

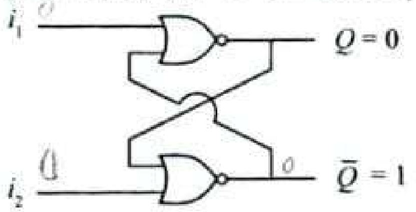
(1) 0 bits (2) 512 bits (3) 1024 bits (4) 512 bytes (5) 1024 bytes

12. If the two signed numbers 185_{10} and 96_{10} are added using 8-bit registers, what is the value of the result stored in the relevant register?

(1) -128_{10} (2) 25_{10} (3) 127_{10} (4) 255_{10} (5) 281_{10}

13. Consider the following flip-flop:

Which of the following statements will be true when $i_1 = 0$ and $i_2 = 1$?



(1) Q output will remain at 0 and $\overline{Q}$ output will remain at 1.
(2) Q output will change to 1 and $\overline{Q}$ output will change to 0.
(3) Q output will change to 1 and then to 0.
(4) $\overline{Q}$ output will change to 0 and then to 1.
(5) Q output will remain at 0 while $\overline{Q}$ output will also change to 0.

14. What is the most simple Boolean expression that can be obtained through the given Karnaugh map?

z \ xy	00	01	11	10
0	1	0	0	1
1	1	0	1	1

(1) $\overline{y}$ (2) $y + \overline{x}\,\overline{z}$
(3) $\overline{y} + xz$ (4) $\overline{y} + xyz$
(5) $y\overline{z} + \overline{x}y$

[See page three

15. Consider the following two statements P and Q:

P – Data is represented as a sequence of discrete values in a digital signal.
Q – Even with some corruption, a digital signal is easier to correctly interpret than an analog signal.

Which of the following is correct regarding the above two statements?
(1) Both statements P and Q are correct and the point presented in statement P gives the reason for the point presented in statement Q.
(2) Both statements P and Q are correct but the points presented in those two statements are not connected.
(3) Statement P is correct but statement Q is incorrect.
(4) Statement P is incorrect but statement Q is correct.
(5) Both statements P and Q are incorrect.

16. What does the term *attenuation* refer to in signal transmission?
(1) alteration in the properties of the transmitted signal
(2) increase in the signal strength
(3) loss of signal energy as it travels over a distance
(4) time delay in propagation
(5) the received signal makes no meaning

17. In which of the following is the frequency of the carrier signal varied according to the message signal?
(1) in *amplitude modulation*
(2) in *amplitude shift keying*
(3) in *frequency modulation*
(4) in *frequency shift keying*
(5) in *pulse code modulation*

18. Which of the following statements are correct regarding the *bus topology*?

A – It consists of a main cable with terminators at each end.
B – Devices in the topology are directly connected to each other.
C – Problems occur when multiple nodes try to access the medium at the same time.

(1) A only
(2) A and B only
(3) A and C only
(4) B and C only
(5) All A, B and C

19. Which of the following statements best describes the primary function of a *network switch*?
(1) It amplifies and regenerates signals to travel over long distances.
(2) It connects devices within a LAN and forwards frames based on the MAC addresses.
(3) It connects multiple networks together and routes data traffic between them.
(4) It encrypts data before transmitting them through the network.
(5) It maps domain names into IP addresses.

20. Which of the following statements describe the role of the Media Access Control (MAC) protocol?

A – It ensures orderly access to a shared communication medium.
B – It finds paths and routes data between network hosts.
C – It provides unique addresses to identify network interfaces within a LAN.

(1) A only
(2) A and B only
(3) A and C only
(4) B and C only
(5) All A, B and C

21. Which of the following ISO/OSI layers is responsible for the establishment and maintenance of an end-to-end reliable connection?
(1) Application Layer
(2) Data link Layer
(3) Network Layer
(4) Physical Layer
(5) Transport Layer

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22. Which of the following is true about *open systems*?
(1) They operate independently without external software or hardware.
(2) They limit interoperability to maintain internal control.
(3) They support interoperability, portability and integration using common standards.
(4) They improve performance by restricting third-party software and using only proprietary programs.
(5) They are often incompatible with applications from other platforms.

23. Match the **Systems** labelled from **A1** to **A3** to the corresponding **Descriptions** labelled from **B1** to **B3**.

System
A1 - Decision Support System
A2 - Knowledge Management System
A3 - Enterprise Resource Planning System

Description
B1 - A system that stores and distributes organizational information such as best practices and expertise to employees
B2 - A system that helps managers analyze complex data to identify patterns and make business predictions
B3 - A system that integrates various business processes like accounting, procurement and supply chain operations

(1) A1 – B1, A2 – B2, A3 – B3
(2) A1 – B1, A2 – B3, A3 – B2
(3) A1 – B2, A2 – B1, A3 – B3
(4) A1 – B2, A2 – B3, A3 – B1
(5) A1 – B3, A2 – B2, A3 – B1

24. Which of the following system development lifecycle models facilitate iterative development and accommodate changing requirements?

A – Spiral model
B – Agile model
C – Prototyping

(1) A only (2) B only (3) A and C only
(4) B and C only (5) All A, B and C

25. Column **A** lists the phases of the *waterfall model* with labels **A1** to **A5** and column **B** lists some descriptions with labels **B1** to **B5**:

Column A	Column B
A1 - Requirements analysis	**B1** - Updating the software after deployment
A2 - System design	**B2** - Writing codes based on detailed system specifications
A3 - Implementation	**B3** - Validating whether the system meets user needs and functions correctly
A4 - Testing	**B4** - Identifying what the system should do through discussions with stakeholders
A5 - Maintenance	**B5** - Creating detailed technical architecture and data flow diagrams

What is the correctly matched phase-description pair?
(1) A1 – B5 (2) A2 – B4 (3) A3 – B2 (4) A4 – B1 (5) A5 – B3

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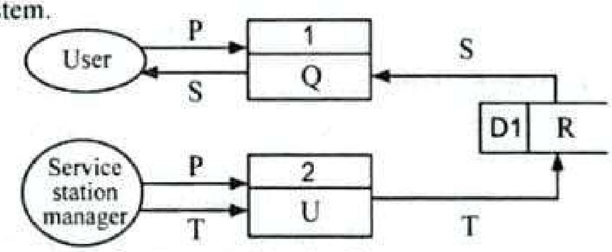
26. Assume that a project is to be done to computerise the administration of all government schools. The system developers in the project have been advised to use the Structured System Analysis and Design Methodology (SSADM) for it.
What is a key benefit of using SSADM in this project?
(1) It allows faster development with minimal documentation.
(2) It avoids documentation effort completely.
(3) It eliminates the need for system analysis.
(4) It encourages rapid software deployment.
(5) It ensures standardization and consistency of the entire project.

27. Which of the following statements about *system testing* are correct?
A – It verifies that the complete and integrated system meets the specified requirements.
B – It is normally performed by end-users to validate software functionality.
C – It is performed before *unit testing* in the standard software testing life cycle.
(1) A only (2) B only (3) A and B only
(4) A and C only (5) B and C only

28. A software tester reviews a code part that calculates a discount based on a person's age and purchase history by manually tracing each *if-then-else* condition branch.
What testing is this?
(1) Acceptance testing (2) Black-box testing (3) Integration testing
(4) System testing (5) White-box testing

29. A university replaced its old Learning Management System (LMS) with a new one. However, the new LMS was initially made available only for the first year students. After this successful trial, it was made available for the other students too by stopping using the old LMS completely and starting the new LMS on a specific date.
What type of deployment method is used in this changeover?
(1) Direct only (2) Phased only
(3) Pilot and direct only (4) Pilot and parallel only
(5) Pilot and phased only

30. Assume that a vehicle maintenance information system is to be developed. When a vehicle's registration number is input to the system, the system should output the maintenance work records of the vehicle to the user. (e.g., On Aug 19th 2025, the oil of this vehicle was changed.) A service station manager, should also be able to add new work records to the system whenever such work is done to the vehicle.
Shown below is the first-level DFD of the system.



Which of the following gives the correct replacements for P to U in the diagram?

(1) P – New work record, Q – Display work records, R – Service station managers, S – Work history, T – Registration number, U – Add work record
(2) P – New work record, Q – Add work record, R – Registration numbers, S – Work records, T – Registration number, U – Display work records
(3) P – Registration number, Q – Add work record, R – Service station managers, S – Work records, T – New work record, U – Display work records
(4) P – Registration number, Q – Display work records, R – Work history, S – Work records, T – New work record, U – Add work record
(5) P – Work history, Q – Display work records, R – Registration numbers, S – Work records, T – New work record, U – Add work record

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31. Consider the following relations from a database at a University. The database is used to keep data about the marks of students taking different courses, the teachers who teach the courses and the department that each teacher is working at:

RESULT(Student_id, Course_id, Mark)
STUDENT(Student_id, Student_name, Student_phone)
COURSE(Course_id, Course_name, Teacher_id)
TEACHER(Teacher_id, Teacher_name, Teacher_phone, Dept_id)
DEPARTMENT(Dept_id, Dept_name, Dept_phone)

Which of the following is **not** a foreign key in this schema?
(1) Student_id in the RESULT relation
(2) Course_id in the RESULT relation
(3) Student_id in the STUDENT relation
(4) Teacher_id in the COURSE relation
(5) Dept_id in the TEACHER relation

32. Consider the following schema of a table that is designed to store data about students:

Name	Type	Null	Key	Extra
Student_id	INT	NO	PRI	AUTO_INCREMENT
Student_name	VARCHAR(100)	NO		
Email	VARCHAR(50)	YES		
Age	INT	YES		

Which of the following statements are true?
A – Student_name cannot be empty when inserting a record.
B – The same email address (Email) could be entered for two students.
C – Inserting a student without specifying the Student_id will result in an error message.

(1) A only (2) B only (3) C only
(4) A and B only (5) All A, B and C

33. Which of these is an advantage of using a compiled language compared to an interpreted language for implementing a program?
(1) less development time
(2) easier debugging
(3) faster execution of the developed program
(4) portability of the developed program
(5) error detection at program run time

34. Which of the following statements are correct?
A – *Assembler* is a translator for the *Assembly* language.
B – Compilers detect only logical errors when compiling a program.
C – Program compilation is a major task of the operating system.
D – An interpreter converts a program completely to an executable file.

(1) A only (2) B only (3) A and C only
(4) B and D only (5) C and D only

35. Consider the following A, B, C and D variable initializations in Python:

A = 1.2   B = "True"   C = (1,2,3)   D = True

Which of the following gives the correct data types of A, B, C and D respectively?
(1) float, bool, list, bool
(2) float, bool, str, str
(3) float, bool, tuple, bool
(4) float, str, dict, bool
(5) float, str, tuple, bool

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36. What is the execution output of the following Python expression?

```
(1,2,3)[-1]+ 3 * 4
```

(1) 13 (2) 15 (3) 16 (4) 24 (5) TypeError

37. What is the execution output of the following Python code?

```
x = "01101"
t = 0
p = 0
for i in x:
   if(int(i)):
         t = t + 2 ** p
   p = p + 1
print(t)
```

(1) 4 (2) 16 (3) 20 (4) 22 (5) 24

38. Following labelled Python code has been written to display all records from the 'Book' table of the 'Books_database':

```
import mysql.connector

mydb = A(host="localhost", user="devi", password="M4PQ#2Ag", database="Books_database")

mycursor = B
mycursor.execute(C)
myresult = mycursor.fetchall()

for x in myresult:
    print(x)

mycursor.close()
mydb.close()
```

Which of the following gives correct replacements for labels **A**, **B** and **C**?

(1) A – `mydb.cursor()` B – `"SELECT * FROM Book"` C – `mysqli`
(2) A – `mysql.connector.connect` B – `mydb.cursor()` C – `"SELECT * FROM Book"`
(3) A – `mysql.connector.connect` B – `open('mydb','r')` C – `"SELECT * FROM Book"`
(4) A – `mysqli` B – `open('mydb','r')` C – `mysql.connector.connect`
(5) A – `mysqli` B – `mysql.connector.connect` C – `open('mydb','r')`

39. Assume that you have to design the following systems. For which of them will you require the users to login to the system with usernames and passwords in order for them to use those systems?

A – A learning management system for students to download learning resources and upload assignments
B – An online banking system to let users transfer funds to other users
C – A system to let the public know about the services of a Government department and its opening hours

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

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40. Nithya saves the following HTML code as *beach.html* on her desktop computer:

```
<!DOCTYPE html>
<html>

<h1>Beach</h1>
<body>
<picture>
<source media="(min-width: 1024px)" srcset="beach_large.jpeg" alt="Large beach  picture">
<source media="(min-width: 760px)" srcset="beach_medium.jpeg" alt="Beach picture">
<img src="beach_small.jpeg" alt="Small beach picture">
</picture>
</body>
</html>
```

Note: 1. Assume that she has *beach_large.jpeg*, *beach_medium.jpeg* and *beach_small.jpeg* files also in the same folder of her computer.

2. The `picture` element can be used to specify different images to be displayed for different devices or screen sizes.

3. The `media` attribute specifies what media or device the linked resource is suitable for and the `srcset` attribute specifies the URL of the image to be used.

Which of the following statements are true?

A – This file is using an external style sheet.

B – When Nithya opens this file through the largest browser window of her computer, the *beach_small.jpeg* image is displayed.

C – When Nithya emails only the *beach.html* file to Kamala and when Kamala opens it through her smart phone, the 'Small beach picture' text is displayed.

(1) A only (2) B only (3) C only
(4) A and C only (5) B and C only

41. A web page is shown in Figure 41.1 and part of the HTML source that was used to make it is shown in Figure 41.2 with five tags labelled from **A** to **E**.

Figure 41.1

Zero trash!

This is a low cost way to compost kitchen waste:

Get three concrete well rings.

Put the daily collection of compostable waste from your kitchen in one ring. Cover the waste with a thin layer of soil. Repeat until the ring is full. When it is full, use the second ring the same way. Once the second ring is also full, use the third ring. But now you can take covering soil from the first ring as the content in it would have been turned to compost by now. When the third ring is full, the first one is likely to be empty so that you can repeat filling it with waste using soil for covering from the second ring.

Be happy that you are not burdening the town council anymore with kitchen waste and that you are making your own fertilizer!

Watch a video on the method.

Figure 41.2

```
<A>Zero trash!</A>
<B>This is a low cost way to compost kitchen waste:</B>
Get three concrete well rings.
<p><C src="rings.jpg" alt="An image of three rings" width="200" height="100"></p>
Put the daily collection of compostable waste from your kitchen in one ring. Cover the waste with a thin layer of soil. Repeat until the ring is full. When it is full, use the second ring the same way. Once the second ring is also full, use the third ring. But now you can take covering soil from the first ring as the content in it would have been turned to compost by now. When the third ring is full, the first one is likely to be empty so that you can repeat filling it with waste using soil for covering from the second ring.
<p><D>Be happy that you are not burdening the town council anymore with kitchen waste and that you are making your own fertilizer!</D></p>

<a E="composting.mp4">Watch a video on the method.</a>
```

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Which of the following gives the correct replacements for A to E?

(1) A – h1, B – p, C – img, D – em, E – href
(2) A – h1, B – p, C – img, D – em, E – video
(3) A – h1, B – p, C – href, D – b, E – video
(4) A – style, B – em, C – img, D – p, E – href
(5) A – style, B – p, C – body, D – em, E – video

42. Which of the following is the correct way to include the 'shop.css' external CSS file to an HTML file?

(1) shop.css
(2) <css src="shop.css">
(3) <style src="shop.css">
(4) <stylesheet>shop.css</stylesheet>
(5) <link rel="stylesheet" href="shop.css">

43. Which of the following technologies is most convenient to make the colour of all the second level (h2) headings of a website to blue?

(1) Apache (2) CSS (3) HTML (4) MySQL (5) PHP

44. Which of the following statements are true?

A – Even when analog inputs are given to the digital pins of an Arduino board, they are read as analog values.
B – The USB port of an Arduino board can also be used to supply DC (direct current) electric power to it.
C – To input the room temperature to an Arduino board, the V_{out} pin of the LM35 temperature sensor could be used.

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

- Consider the following code with labels **P-S** to answer questions **45** and **46**. The code has been designed for an Arduino board to switch on/off a motor based on room temperature.

```
const int      sensorPin = A0;
const int      motorPin = 8;

void setup() {
        pinmode(motorPin, P );
}

void loop() {
        int sensorValue = Q (sensorPin);
        float voltage = sensorValue * 5.0 / 1024;
        float temp = voltage * 100;
        if (temp > 40)
                R (S , HIGH);
        else
                R (S , LOW);
}
```

45. Which of the following contains the correct replacements for the labels?

(1) P – INPUT Q – analogRead R – digitalWrite S – motorPin
(2) P – INPUT Q – digitalWrite R – analogRead S – motorPin
(3) P – OUTPUT Q – analogRead R – digitalWrite S – motorPin
(4) P – OUTPUT Q – analogRead R – digitalWrite S – sensorPin
(5) P – OUTPUT Q – digitalWrite R – analogRead S – sensorPin

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46. Which of the following statements are true?

A – The input from the temperature sensor could have been connected to any of the pins A1-A5 as well but then the `const int sensorPin = A0;` line in the code should be changed to reflect that change.

B – The motor should be connected to a GND pin of the Arduino board.

C – The above code when correctly completed can be compiled and uploaded through the USB port to the Arduino microcontroller by using the 'Upload' button in the Arduino IDE.

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

47. Which of the following statements are true?

A – IPv6 is highly suitable for scalability and efficient operation of Internet of Things (IOT).

B – Once added to the Arduino board, an Ethernet Shield facilitates the board to connect to the Internet.

C – Static IP addresses cannot be used for IOT devices.

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

48. What is the suitable replacement for the blank in the following statement?

By analyzing historical data of a person's previous hotel visits and his/her .... submitted to social media of the same, an AI-based hotel recommendation system should be successfully able to suggest hotels that the person would like.

(1) email addresses (2) payment records (3) phone numbers
(4) reviews (5) street addresses

49. Which of the following statements are true with respect to *Artificial Intelligence* (AI)?

A – AI applications are also computer programs.

B – All AI applications are automatically generated.

C – When AI technology is used to generate new content, it is suitable to disclose that the content was generated by AI.

(1) B only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

50. Which of the following problems are suitable to be solved using *nature inspired computing* technologies?

A – make the monthly payroll list of the employees of a large multinational organization

B – the use of autonomous robots to move goods in a warehouse avoiding collisions

C – scheduling hospital operating theatre time slots for the patients in the surgery waiting list

(1) A only (2) B only (3) C only
(4) A and C only (5) B and C only

* * *

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved]

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
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තොරතුරු හා සන්නිවේදන තාක්ෂණය II
தகவல், தொடர்பாடல் தொழினுட்பவியல் II
Information & Communication Technology II

20 E II

Part B

※ *Answer any **four** questions only.*

5. (*a*) Prove the following using Boolean algebra:

$$\bar{a}\bar{b}cd + \bar{a}bc\bar{d} + \bar{a}bcd + ab\bar{c}\bar{d} + abc\bar{d} + abcd = \bar{a}cd + ab\bar{d} + bc$$ (05 *marks*)

(*b*) A bank vault is secured by a logic circuit with four binary inputs. Three of these inputs come from the keys named k_0, k_1 and k_2 and the fourth input comes from a timer. The four inputs together form a 4-bit binary number with the timer input as the Most Significant Bit (MSB) and k_0 as the Least Significant Bit (LSB).

The vault unlocks only when the 4-bit binary input (from timer, k_2, k_1 and k_0 respectively) represents a number that is a multiple of 3 (i.e., 3, 6, 9, 12, 15) or a multiple of 7 (i.e., 7, 14).

Design the most simplified logic circuit that takes these four inputs and gives an output Z which is equal to 1 for the valid input combinations to indicate the unlocking of the vault. (07 *marks*)

(*c*) Key k_1 is held by the officer-in-charge, while k_0 and k_2 are held by two senior officers. The duration in which the time signal becomes 1 is decided by the bank. State whether the vault can be opened in the absence of the officer-in-charge. Justify your answer. (03 *marks*)

6. (*a*) Write down the suitable replacements for the blanks labelled *A*, *B* and *C* of the following paragraph:

*User Datagram Protocol (UDP) is a transport layer protocol used by several well-known application layer protocols. ...**A**... and ...**B**... are two such application layer protocols that use the services of the UDP. Although UDP is simple it does not guarantee ...**C**... delivery of data.* HTTP FTP Safe (1.5 *marks*)

(*b*) Other than viruses, a number of different types of malware can be accompanying the files downloaded from the Internet. List **three** such types of malware. (1.5 *marks*)

(*c*) Draw a detailed diagram of a network in which three computers, two servers and a network printer are connected in a bus topology. In your diagram show all necessary components that are required. (02 *marks*)

(*d*) Write **one** example for each of the following:

(i) Class B IP address 240.250.06.20 (0.5 *marks*)

(ii) Private IP address 255.255.255.192 (0.5 *marks*)

[*see page ten*

(e) Write down the matching of each **TCP/IP layer** labelled from **A** to **D** with the correct **description** labelled from **1** to **4**. (**Note:** Use only the given labels for your answer.)

TCP/IP layer
A - Application layer
B - Transport layer
C - Internet layer
D - Network access layer

Description
1 - Does routing and path determination for data packets
2 - Breaks down data into segments and ensures reliable delivery of data
3 - Manages the physical transmission of data
4 - Provides network services to user software

(02 *marks*)

(f) Write down the purpose of attaching digital signatures to digital documents. (02 *marks*)

(g) Suppose that you are given the 192.168.50.0/24 IP address block to allocate it to five departments namely **D1**, **D2**, **D3**, **D4** and **D5** that need 28, 12, 60, 6 and 2 usable hosts respectively.

For each departmental subnet, give the indicated data in a table according to the following table format.

Department Name	Network address	Usable IP address range	First usable IP address	Last usable IP address	Broadcast IP address

(05 *marks*)

7. Saman owns a small shop, 'Ceylon Crafts' in Kandy, which sells wood carvings and batik fabrics mainly to tourists. At the moment it is run entirely as a physical shop, with customers visiting in person and paying in cash.

(*a*) While keeping his physical shop, Saman decides to join the digital economy. For this, he creates an online shop to list his products and to accept online payments from customers.

(i) Previously, the business operated as a *pure brick* organization. After introducing the online shop, what is the new form of the business? (0.5 *marks*)

(ii) Saman makes agreements with some nearby tourist hotels to display his products on their websites to direct buyers to his online shop. State the e-commerce transaction type between Saman and the tourist hotels selecting from B2B, B2C, C2C and C2B. (0.5 *mark*)

(iii) From the types listed in (ii) above, what is the e-commerce transaction type between Saman and a customer who buys a product online? (0.5 *mark*)

(iv) Write down **one** payment method that Saman could provide for customers in his online shop. (0.5 *marks*)

(v) Saman wants to expand his online shop to local suppliers who desire to supply their crafts to Saman. For this purpose, the suppliers are to be given the facility to upload the images of their crafts, submit their prices and the way to contact them. List **four** *digital divide* related problems that Saman could face in this endeavour. (02 *marks*)

(vi) For **one** of the problems that you listed in (v) above, explain a solution that Saman could provide. (02 *marks*)

(*b*) Saman has a future plan to include three software agents in this online shop as follows:

Help Agent – interacts with the customer and answers questions about products and delivery times

Price Agent – checks for available discounts and seasonal offers before showing the final price

Delivery Agent – communicates with different delivery services to select the fastest and cheapest option

(i) From these three agents, which one is mainly an *interface agent* and why? (01 *mark*)

(ii) Draw a simplified agent diagram for the above multi-agent system. Properly label the diagram and show all the interactions clearly. (02 *marks*)

(iii) Give **one** advantage of using several software agents in Saman's online shop instead of building one single large program to do all the work. (02 *marks*)

(iv) These agents are expected to work autonomously. Describe **one** situation where the **Delivery Agent** should take an action without being directly instructed by the user. (02 *marks*)

(v) Describe **one** situation where the **Delivery Agent** may give the customer incorrect information. (02 *marks*)

8. Your class teacher has requested you to develop a menu-based Python application to manage the examination marks of the students of your class and has provided you with the following requirements of the application.

A) Each student of the class is to be identified by a unique index number such as s01, s02 etc.

B) Each student sits for three papers namely ICT, Physics and Chemistry.

C) The menu should provide the following options:

1) Read marks of a student from the keyboard
2) Display marks of all students on the screen
3) Exit from the application

Where the option 1) allows a user to enter an index number and subject marks of a student, option 2) displays the index numbers and marks of students already entered and option 3) exits from the application.

(*a*) Write a python function to display the above menu on the screen allowing the user to type a menu option and to return the option the user entered. (03 *marks*)

(*b*) If a python list of tuples is used to store the marks of students, write a python function to return a tuple comprising the index number and marks for the three subjects when the index number and the three marks obtained by a student are given.
(For example, if the function is defined as getMarks(indexNumber, mark1, mark2, mark3), it should return a tuple comprising the indexNumber, mark1, mark2 and mark3.) (04 *marks*)

(*c*) Write a python function by using the above function to read the marks of multiple students and add them to a list of tuples with the name **classMarks**. Your function should terminate when the user enters –1 as the index number. (04 *marks*)

(*d*) Write down a python function to display the marks of a student on the screen given his/her index number. (04 *marks*)

9. (a) Your school needs an Event Management System to manage the events of different school clubs such as the Science Club, Sports Club and Literary Association. You have been asked to design a suitable database system for this and are provided with the following information:

- Each student has a unique student number [StuID], a name [StuName], a class [Class] and an e-mail address [Email].
- A student can join [Joins] one or more clubs.
- Each club has a unique number [ClubID], a name [ClubName], a location [Location] and a teacher-in-charge [TeacherID].
- Events are conducted [Conducts] by clubs. Each event has a unique event number [EventID] and a name [EName]. A club can conduct many events, but each event is conducted by only one club. For each event, the system should record the start date [StartDate] and the end date [EndDate].
- A student can participate [Participates] in many events, and in each event, the student can have one of three roles: organizer, volunteer or participant. The system should record the student's role [Role] in each event that he participates.

(i) Draw an Entity-Relationship (ER) Diagram for the above system showing the entities, attributes, relationships and the appropriate cardinalities for each relationship. Underline the primary key attributes.

[**Note:** Use only the terms given within square brackets in the above description for the attributes and relationships.] (05 *marks*)

(ii) Write the relational schema for the above ER diagram.

[**Note:** List only the tables with their attribute names. Underline the primary keys.] (04 *marks*)

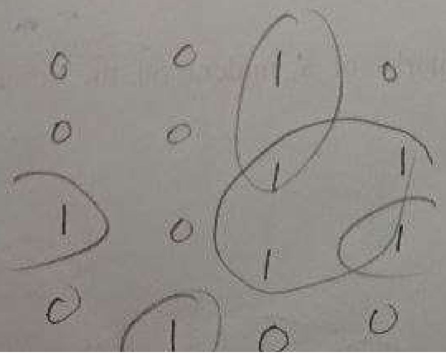
(*b*) The table below shows some records of student participation at school events. Each record contains information about the student and the corresponding event. The '**Services**' column indicates any additional services the student used during his participation in the event.

Stu_ID	Stu_Name	Phone	Event _ID	Event _Type	Event _Fee	Services	Start _Date	End _Date
S001	Perera	0771234567	E101	ICT Fair	2000	Refreshments	2025-07-01	2025-07-03
S002	Selvan	0777654321	E102	Debate	1500	Refreshments	2025-07-02	2025-07-05
S003	Fernando	0711237890	E101	ICT Fair	2000	Printing	2025-07-01	2025-07-03
S004	Nadaraja	0752341234	E104	Exhibition	2500	Transport	2025-07-03	2025-07-06
S001	Perera	0771234567	E102	Debate	1500	Printing	2025-07-02	2025-07-05

(i) In which normal form does the above table exist? Justify your answer. (02 *marks*)

(ii) Convert the above table to the next normal form and list the tables obtained after the conversion giving the attributes. Underline the primary key of each table. (04 *marks*)

$\bar{K_0}.K_1.K_2.\bar{K_3} + K_0 + K_0.K_1 + K_2.K_{4}3$



1
3
5
4

10. A student has developed a system using html, php and mySQL for users to reserve doctor appointment slots at the village hospital. The hospital is open for outpatients from 0800 - 1700 hrs each day. However, for simplicity, the student has considered only four 15-minute appointment slots per day (i.e., 0800, 0815, 0830 and 0845 hrs). The system uses a database table named **BOOKING** with the following structure to store the time slots already reserved:

BOOKING(<u>Date</u>, <u>Time</u>, Name, Phone)

Note: *Date*: Date of the appointment — *Name*: Patient's name
Time: Time of the appointment — *Phone*: Patient's contact phone number

(*a*) A user enters the required appointment date to the system's initial interface shown in Figure 10.1. Without even checking the BOOKING table, what dates should the system **not** allow the user to input? (01 *mark*)

(*b*) The slot availability information for the selected appointment date is shown by the *list.php* file. Two different colours are used to indicate reserved and unreserved slots. A sample output is shown in Figure 10.2.

(i) An <u>extract</u> of the file list.php is shown in Figure 10.3. In it, what is the *result* variable expected to contain? (01 *mark*)

(ii) In Figure 10.3, the code part indicated by **A** contains three code lines. Write down its **first** code line. (01 *mark*)

(iii) **B** in Figure 10.3 should contain a message to be printed on the screen. What should be stated in it? (01 *mark*)

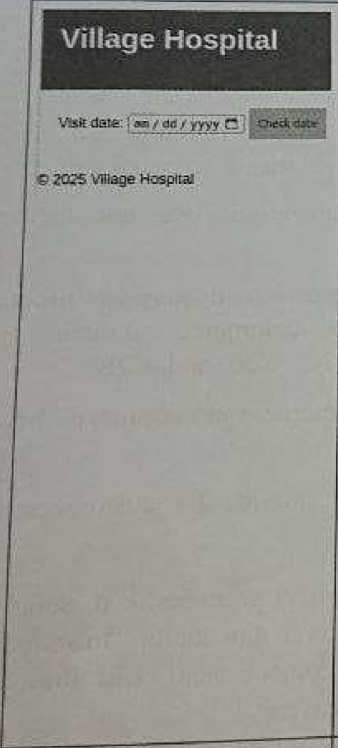


Figure 10.1

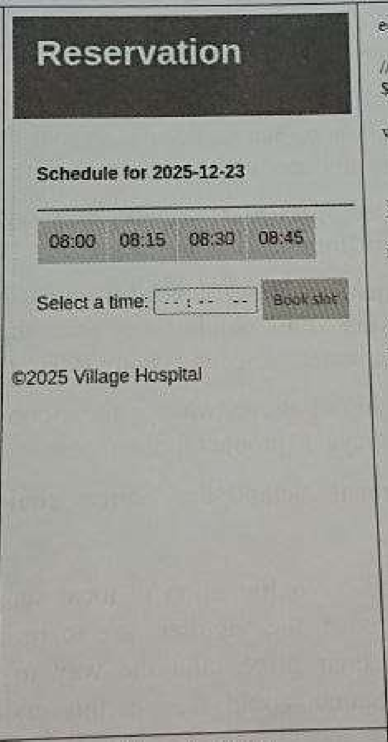


Figure 10.2

```
echo "<h4>Schedule for $visit_date</h4>";

// make all slots initially available for booking
$avail = [1, 1, 1, 1];

while ($row = $result->fetch_assoc()) {
  if ($row['Time'] == '08:00:00') $avail[0] = 0;
  A
} // end while

if ($avail[0] == 0 and $avail[1] == 0
  and $avail[2] == 0 and $avail[3] == 0) {
  echo "B";
}
else { ?>
  C
    <?php
     if (D) echo "E"; else echo "F";
     X
    ?>
  </tr>
 </table>
 <!The'submit' code (not shown)-->

 <?php
 }
 ?>
```

Figure 10.3

(iv) Write down the suitable replacements for **C**, **D**, **E** and **F** of the code extract shown in figure 10.3, choosing from the following list.

List: {$avail[0] == 0, <td style='background-color: green'>08:00</td>,
<td style='background-color: red'>08:00</td>, <hr>, <table>, <tr>}

Notes: 1. The part **C** requires the use of three of the replacements.
2. The part **X** containing the code for other time slots need **not** be written. (04 *marks*)

[see page fourteen

(*c*) The selected appointment date and the time selected through the interface of Figure 10.2 is directed to the *book.php* file for processing. With respect to this input, what database related test should be done in the *book.php* file? (02 *marks*)

(*d*) Write down an important maintenance task that must be done to the **BOOKING** table at the end of each day in order to increase time slot search efficiency and also to reduce storage requirements of the system. (02 *marks*)

(*e*) After its completion, the student suggests hosting this system using a shared web hosting service available from an Internet Service Provider instead of publishing it on a hospital computer. Write down **one** advantage of this approach. (01 *mark*)

(*f*) The annual cost of this shared web hosting package is Rs.7,500. The student suggests a method for the hospital to recover this cost that will also increase resource utilization. Explain the method and how it improves resource utilization. (02 *marks*)

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